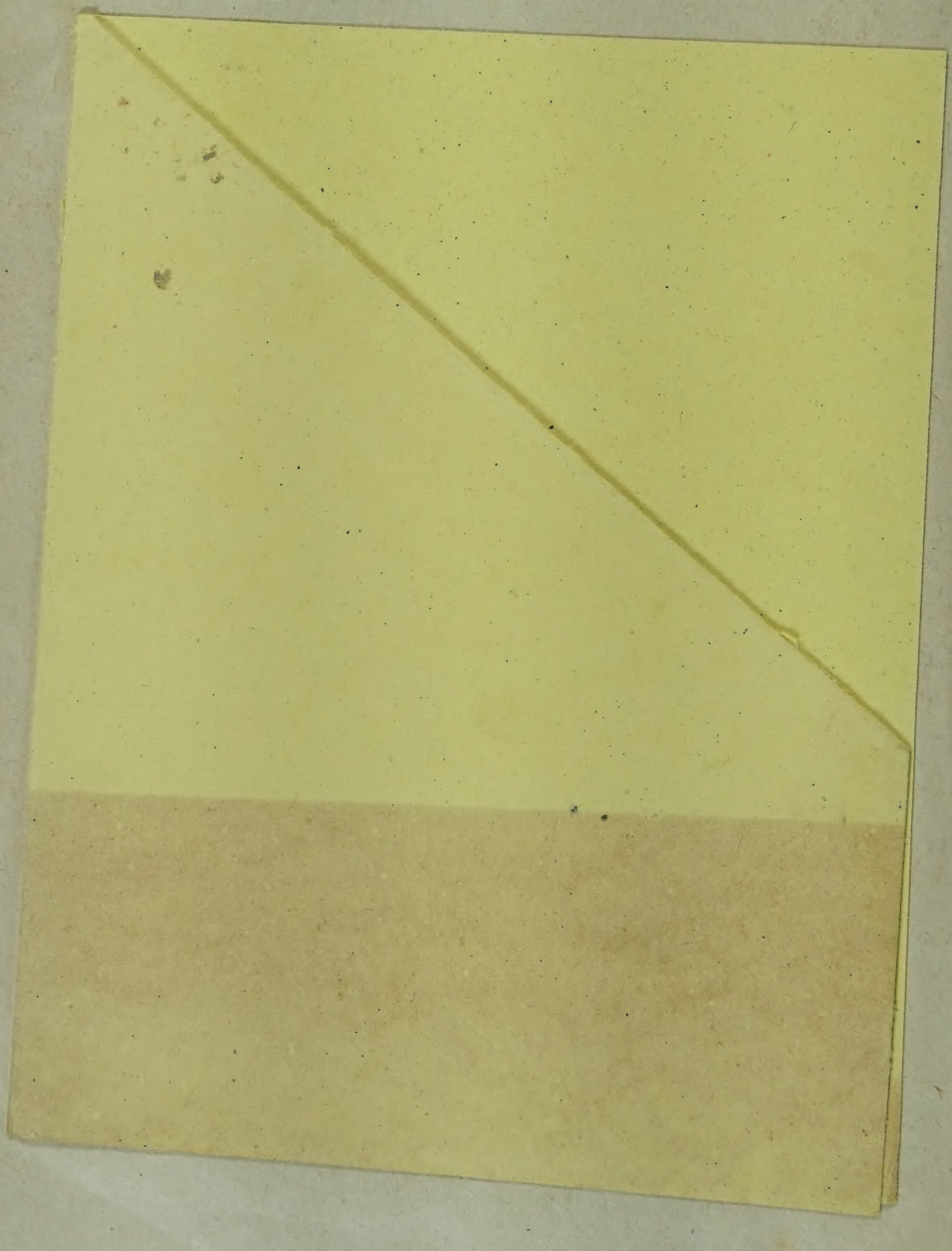
Nuclear Bulletin No. 2

RADIATION

The Greatest Public Health Threat Of All Time

Health And Society Group.



Introduction

It is difficult to exaggerate the danger posed by radiation ; it is difficult to imagine something that could present a greater threat to life on earth. Yet, we cannot perceive its presence through our senses and its effects are insidious. It is only when the full reality of its nature has penetrated our consciousness, our imagination and our understanding that we realise the extent of the danger we are facing. There are many reasons why this understanding has failed to reach the vast majority of people.

1 Relatively few people in the world have witnessed the immediate effects of high dose radiation. For most people Hiroshima is a far off place and what happened there a past event. But for those who live there or have visited since 1945 it is a constant reality. Besides Hiroshima, other fatalities from high dose radiation have taken place within the confines of nuclear power stations or nuclear weapons factories. The relatives of the thousands of people around the world who have died of the long-term effects of lower doses of radiation or the parents of deformed babies, are not usually able to trace the cause of their grief to a source of radiatiou.

2) The Atomic Age began only 36 years ago and considerable uncertainty still exists concerning the long-term effects of radiation. The latency period of cancer is 12 to 40 years and genetic mutations do not often manifest themselves for generations so we have barely began to experience the effects radiation can have on us.

3) Once radiation has leaked into the environment it is impossible to control. Since we are dependent on the environment for our food, water, air, we cannot avoid contamination. There is no protection and no effective treatment. Radiation can persist in the environment of hundreds of thonsands of

years. When the full horror of this dawns on us there are many who close their minds to it : they do not want to know.

4) Another reaction to the horror is that this is a complicated subject and it is for the experts. Often associated with this attitude is a misplaced faith in the ability of science and technology to come up with a solution. The "wonders" of science have engendered a feeling that man can conquer nature whereas, in reality, our survival depends on our co-operation with nature.

5) Lastly, and most important of all, there are very powerful vested-interests at work in government and industry who do not want us to know and who publish misleading information and suppress sources of reliable fact.

We have enumerated here some of the obstacles in the way of informing people about the dangers of radiation. They are obstacles we have to overcome if we and our children are to survive. This bulletin is produced in the hope that it will help to spread awareness and in the faith that it is up to ordinary people to make their voice heard against those who are gambling with our destiny.

December 1981.

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Radiation

"If present trends continue, the air we breathe, the food we eat, and the water we drink will soon be contaminated with enough radioactive pollutants to pose a potential health hazard for greater than any plague humanity has ever experienced."

—Dr. Helen Caldicott in
"Nuclear Madress."

What is Radiation ?

You can't feel it, see it, smell it or taste it, but it can kill you.

All matter is made up of atoms. Some atoms are unstable or radioactive, that is, they spontaneously emit particles and energy (radiation) and go on doing so until they have changed to a stable form. This process is known as radioactive decay. The rate at which radioactive elements decay is measured in terms of 'half-life', that is, the time in which half the material originally present will decay. In this time, the emission of radioactivity will also fall by half. Some elements decay rapidly, Iodine-131, for example, has a half-life of only 8 days, while some have very long half-lives, for example Plutonium-239 has a half-life of 24,400 years. Strontium-90 has a half-life of 28 years. Starting with 1 pound of Strontuim-90, in 28 years there will be $\frac{1}{2}$ pound of radioactive material ; in 28 more years there will be $\frac{1}{4}$ pound and so on. In general 10 half-lives need to elapse before a radioactive element can be considered not to be dangerous.

In the course of radioactive decay atoms give off 3 major forms of radiation - alpha, beta and gamma. Alpha radiation is a stream of (relatively) slow-moving heavy particles which do not have much penetrating power. They do not usually

penetrate the skin. However they can enter the body by ingestion in food or liquids or can be inhaled into the lungs. When this happens all the destructive energy of the alpha particles acts directly on soft body tissue and the biological damage is much greater than any other form of radiation.

Beta radiation is composed of particles several thousand times smaller than alpha particles. It can penetrate a 6″ block of wood and so can pass through the skin to damage body tissue. But, as alpha radiation, it causes most serious and irreparable damage when ingested or inhaled.

Gamma radiation is similar to X-rays and has the greatest penetrating power. It can penetrate concrete more than one metre thick.

Once released into the air, waterways or the sea radioactive elements do not disperse themselves evenly but are taken up by living organisms. There they accumulate and are concentrated. For example, Caesium-137 is concentrated in fish to levels 1000 times those found in the river as a whole. Strontuim - 90 results in far higher concentration in cows and their milk than is found in the grass. The radioactivity does not die with the death of the organism or animal. It is passed on to those consuming the contaminated product and accumulates there .

How radiation harms us.

Body cells have their own specific electrical charge in order to function normally. All forms of radiation harm us by changing the normal electrical charge of an atom within our body cells. The structure of the cells is disrupted and the chemical balance needed to maintain proper functionning of the cell is altered. Sometimes the cells are killed outright or rendered incapable of cell division ; sometimes the damage is repaired ; sometimes the cell nucleus and its store of genetic information is damaged but the cell survives and multiplies in its altered form over a number of years and forms a group of cells that is eventually diagnosed as cancer. When the cell affected is a sperm or egg cell it can give rise to seriously damaged offspring in the next or subsequent generations.

Different organs and tissues in the body absorb different radioactive elements. For example Strontium-90 chemically resembles calcium and is absorbed by our bones and can cause bone cancer and leukaemia. Iodine-131 concentrates in the thyroid gland to cause cancer. Cesium-137 concentrates in muscle tissue and the ova of females. The risk is much greater for the very old and very young. Children are much more susceptible than adults and infants and the unborn are the most susceptible of all with their rapidly dividing cells and immature bodily defence systems.

Plutonium

Plutonium-239 is the most lethal carcinogen (=Cancer-producing substance) known. It is not found in nature ; it is man made. Single particles weighing one millionth of a gram, so small that they can only be seen under a microscope can cause cancer of the lung if inhaled. (When exposed to air it ignites spontaneously to produce particles of plutonium dioxide which can be inhaled.) The toxicity of Plutonium can only be understood by comparison. Potassium cyanide, pellets of which have been used in gas chambers to kill convicted criminals within minutes, is generally thought to be one of the most toxic substances available for use in capital punishment. The single particle of Plutonium just described, however, is 20,000 times deadlier than a whole pellet of potassuim cyanide. Ten pounds of Plutonium evenly distributed amongst every person in the world, would give them all a high probability of dying from cancer. Apart from causing cancer, it is concentrated by the testicles and ovaries, where it will inevitably cause genetic mutations which will be passed on to future generations. Each operating nuclear reactor produces between 400 and 600 pounds of Plutonium each year in its normal operations. It is the essential ingredient in the construction of nuclear weapons.

The degree of damage camsed by radiation depends on the type, the intensity and exposure time. The amount of biologically damaging energy contained in radiation received by an organism is expressed in rems. A very high dose of radiation

say 3,000 rems or more, causes acute encephalopathic syndrome. Within 48 hours of exposure the brain cells swell and cause increased pressure inside the skull leading to delirium, fever, loss of muscle control and death. Such will be the effect of the ' **neutron bomb**" which the Americans plan to produce. A dose of 600 rems produces acute fatal radiation sickness. All actively dividing cells are killed and hence hair falls out, skin is sloughed off in big ulcers, vomiting and diarrhoea occur and then white blood cells and platelets die and victims succumb of infection and / or massive haemorrhage.

Lower doses of radiation cause leukaemia 5 years after exposure, cancer 12—40 years later and genetic diseases and abnormalites in future generations. There is also a growing body of evidence indicating that radiation produces a generalised ageing effect on the body. It accelerates the breakdown of the body and undermines resistance to disease. Data indicates that the amount of radiation received from one heavy abdominal X-ray is equivalent, roughly, to one year of aging.

Sources of radiation.

Natural "background" radiation comes from cosmic rays from outer space and from certain radioactive rock strata. Areas high in natural background radiation show a higher incidence of health problems, for example, in Kerala there is an abnormally high level of radioactive Thorium in the soil believed to be responsible for a high incidence of mongolism and mental retardation there.

Man has so far added an extra 50 percent to the natural background radiation we receive. Whereas cosmic rays are made up of gamma-like rays, man-made radiation contains more alpha and beta particles which, after ingestion in the body, are much more dangerous.

One source of man-made radiation is from medical X-rays. These have saved thousands of lives when used to diagnose and treat diseases. We are now more aware of their dangers than in the past. Mass radiography programmes once so popular are now no longer used. It has been concluded that mass X-ray screening for breast concer resulted in approx-

imately 5 percent more cancers than they detected. Dr. Alice Stewart found that one diagnostic X-ray to the pregnan abdomen increases the risk of leukaemia in the offspring by 40 percent. In the West pregnant women are seldom X-rayed.

Even more importantly, man-made radiation comes from the testing and fall-out of nuclear weapons. Numerous studies have shown health effects. For example in St. George, Utah, U.S. child leukaemia deaths rose by 250 percent following the 1951 Nevada tests.

John Wayne, the American filmstar, died of cancer this year. He was one of a film team that shot a film in the Nevada desert. Since then members of the team are, one by one, dying of cancer.

In Alberta, Canada, the Ministry of Health noted in 1962 a significant increase in stillbirths and birth defects following the U.S.S.R. tests in 1958. Study concluded that each radioactive atom was 10 million to this 100 million times more toxic to developing embryos than molecule of even something as devastating as Thalidomide.*

As well as producing energy, nuclear reactors create large quantities of radioactive materials. Leaks of radioactivity into the environment occur, indeed some "routine" releases of radioactive waste and gas are allowed for in normal operations. Such releases occur at every stage from the mining of the raw material, Uranium, through to processing and storage of the highly radioactive waste products. The Australian Atomic Energy Commission found an incidence of leukaemia and cancer amongst white Australian uranium miners 6 times the expected norm. These considerable health risks not only effect those working but also those living nearby mining areas and nuclear facilities and also transport routes.

* Thalidomide, taken by pregnant women during the 1960's, resulted in the birth of hundreds of grossly defromed children.

Around the Big Rock Point reactor on Lake Michigan, child leukaemia rates were found to be 4 times greater than the rest of the Michigan State.

A study by the Bremen Institute for Biological Safety on the population around the Linger reactor in W. Germany. found that 10 years prior to the operation of the plant there were 30 leukaemia deaths. In the 10 years after nuclear operations began (1968-78), the same population suffered 230 deaths from leukaemia, 170 of these were children under 15 years old.

Many of the radioactive elements in nuclear wastes remain potentially dangerous for hundreds or even thousands of years. We still have no safe way to store them in isolation from the environment for this length of time. Meanwhile they accumulate leaving a problem for future generations. Some waste is dumped. For example 6000 curies (a curie is a measure of the amount of radiation given off by a substance) of Plutonium may be legally dumped in the Irish sea each year. As a result, the level of radiation in the Irish Sea shows a ten-fold increase.

Accidents

Far from being as improbable as the nuclear industry would like us to believe, accidents in nuclear power reactors are a very common event.

In the U.S. in 1976 every 2½ days there was a reported failure of containment isolation at a nuclear reactor ; a reported failure of main cooling occurred 116 times that year ; failure of reactor protection 82 times ; failures of other core and containment cooling systems 528 times. Altogether, there was one failure every seventeen hours...

This incredible state of affairs becomes more credible when one learns of the design and construction faults, the cracks and corrosion of materials and radioactive leaks combined with sheer carelessness.

Two reactor pressure vessels at San Onofre, California were found to be installed backwards.

Safety instruments at Zion, Illinois, were wrongly wired.

A 3000 gallon radioactive waste tank is found to be connected with the plant's drinking water system.....etc.

The picture is similar in other countries. By the late 1960's nuclear plants in Britain, the U. S., the U. S. S. R., Canada and Switzerland had all experienced major accidents. Carrying out repairs is an extremely hazardous task in which workers risk their lives and some have been killed. Sometimes repairs are impossible and the whole plant is filled with concrete and entombed as happened after the immense fire in windscale, Britain in 1957.

The most serious accident that can occur at a nuclear reactor results from the loss of coolant in the reactor vessel. The nuclear fuel in the core then heats up to such a degree that it melts forming a mass of white-hot radio-activity. This is called a meltdown. If emergency measures fail, as they frequently have, or are wrongly managed, the core begins to melt and collapse within 30 to 60 seconds. No one knows what would follow nor what, if anything, could be done. It is conceivable that it will melt its way through the floor and foundations and begin burrowing its way into the earth. Hence the name "China Syndrome." At Harrisburg. U. S., in March 1979 a meltdown was only narrowly avoided and the dangers are not over yet. The plant now contains thousands of gallons of contaminated water and radioactive gas which no one knows how to deal with.

In 1958 a huge explosion occurred at a plant in the S.Urals, U.S.S.R. Hundreds of square miles of land were so heavily contaminated that entire villages were wiped out by death and evacuation. It is now a waste land devoid of life. The map of the area has been redrawn.

Any dose of radiation is an overdose

Until 1960 the view was prevalent that there is a threshold level of exposure to radiation below which no harm can result. Nuclear reactors were built on the basis of this theory. They cannot operate without it for, as we have seen, radioactive releases are routine. But the view that low doses of radiation are safe has long since been abandoned.

The truth is that there is no safe dose of radiation because it takes only one radio-active atom, one cell and one gene to initiate the cancer or mutation cycle. Any exposure at all therefore constitutes a serious gamble with the mechanisms of life. It is important to realise that the effects of radiation build-up from one exposure to another. Successive doses of radiation add on to the damage done by the previous dose. The biological effects of receiving separate small amounts of radiation over time may be the same as receiving a large dose all at once.

The nuclear authorities have been obliged to progressively lower the permitted levels of exposure to radiation for workers in industry :

1925	52 rem / year
1934	36
1950	15
1957	5

5 rems is the equivalent of severalh undred chest X-rays. The public can at present legally receive 0·5 rem, the equivalent of 17 chest X-rays.

Even these levels are considered by some experts to be far too high.

A study at the Hanford Atomic Works in the U.S.A. involving 25,000 men and women over a period of 29 years concluded that the dose required to double a worker's risk of cancer was well below the permitted 5 rems a year. Less than 1 rem is the doubling dose for bone marrow cancer.

The cover-up

The reason that the nuclear authorities are not concerned with this evidence is quite simple—they are more interested in porfits than in health. They therefore try to suppress studies relating to the dangers of radiation. They do this by cutting off funding as in the case of Dr. Thomas Mancuso, physician and professor in the Public Health Department of the University of Pittsburg, U.S., and Dr. Irwin Bross and Dr. E. J. Sternglass, Professor of Radiation Physics. They also engage in personal attacks on these scientists quite out of keeping with the rational and objective assessment of evidence that should be the basis of scientific judgements. Information about accidents is suppressed and the damage done is disregarded. At the same time the data used to support the nuclear industry's arguments is unsatisfactory. For example it does not take account of the long latency periods of cancers and fails to recognise evidence to other blood diseases and damage to immune systems apart from cancer. The nuclear authorities arguments have been based on highly suspect experiments.

The A.E.C. (Atomic Energy Commission. It was replaced due to charges of corruption by the N.R.C., Nuclear Regulatory Commission but with no appreciable change of staff,) studies were conducted to determine whether food crops would take up dangerous levels of radioactivity from the soil. Before beginning the experiments, A.E.C. scientists made preparatory tests on a variety of soils choosing for their experiments those soils which absorbed the

least amount of rediation. Furthermore, as it was then wellknown that plants have difficulty assimilating radiation until they are acted upon by soil bacteria, the scientists cooked their soil in ovens, thus killing its bacteria. Finally the A.E.C. experimenters added the radioactive substances to the soil just shortly before the plants were harvested, there by avoiding the normal condition of plants growing from seed in contaminated soil. Not surprisingly, their conclusions showed hardly any radioactivity getting into the plants.

While continuing to assure the public that nuclear power is safe, neither government, nor nuclear industry nor insurance companies have been willing to insure the utility companies owning the nuclear reactors for the amount that would be necessary to be paid out in damages when an accident occurs.

Safety inspections by the N.R.C. in the U.S. are generally confined to spot checks a few days each year. Daily responsibility for plant inspection and radiation monitoring rests with the company. Such an arrangement is similar to allowing restaurant owners to inspect the cleanliness of their own kitchens. The fact is that the agencies appointed to regulate the nuclear industry in reality act to promote it. Falsifying records concerning the radiation exposure of workers, for example, is a common practice :

"We had these film badges we wore to indicate exposure. Every few days they'd take up the badges and send them off to the Oak Ridge National Laboratory (also run by the company) for analysis. One day a few of us men laid our badges on a smoking chunk of uranium for eight hours and turned it in. We never heard from it. They took urine samples from us every ten days. Once somebody dropped a small chunk of uranium in the urine sample. Nothing was ever said about it."

This worker from Oak Ridge, Tennessee, died in March 1980. His official death certificate asserts death from heart failure. But he had a 30 pound cancerous tumour spread around his spinal column.

The I.C.R.P. (International Commission on Radiological Protection) is now recommending an increase in permissible dose levels of between 2 to 8 times ! In their latest publication (No 26) they make the extraordinary statement : "Medical surveillance has no part to play in confirming the effectiveness of a radiological protection programme."

Ultimately the question of radiation should be a public debate about social and political issues as well as technical and scientific ones; about men and women deciding whether they are prepared to believe in the experts' latest assessment of the risk,and whether, even if they believe it, they are prepared to take that risk.

Information compiled by Janet Aitken from :

1) "From Hiroshima to Harrisburg" by Jim Garrison.
2) "Nuclear Madness" by Dr. Helen Caldicott.
3) "The Big Risk, Nuclear Power" by Michael Flood.
4) "Radiation your health at risk" published by the Radiation and Health Information Service.

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Available :

Nuclear bulletin 1 : "The Worldwide Threat of Nuclear Technology." Rs. 0.75.

In preparation :

Nuclear bulletin 3 : "The only way out of the nuclear nightmare" by George Kennan. Rs. 0.50.

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